Don't Be Fooled by Sales, understand VLAN properly

Mikrotik User Meeting
Indonesia, 15 oct 2020

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GLC Networks

Agenda

- Introduction
- The birth of VLAN
- VLAN on Mikrotik
- VLAN on RouterOS
- Demo
- Q & A

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What is GLC?

- Garda Lintas Cakrawala (www.glcnetworks.com)
- Based in Bandung, Indonesia
- Areas: Training, IT Consulting
- Certified partner for: Mikrotik, Ubiquity, Linux foundation
- Product: GLC radius manager
- Please check our schedule on website

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About me

- Name: Achmad Mardiansyah
- Base: bandung, Indonesia
- Linux user since 1999, mikrotik user since 2007,
- Mikrotik Certified Trainer (MTCNA/RE/WE/UME/INE/TCE/IPv6)
- Mikrotik Certified Consultant
- Teacher at University (Bandung, Indonesia)
- Currently a student …. :-)
- Website contributor: achmadjournal.com, mikrotik.tips, asysadmin.tips
- More info: http://au.linkedin.com/in/achmadmardiansyah
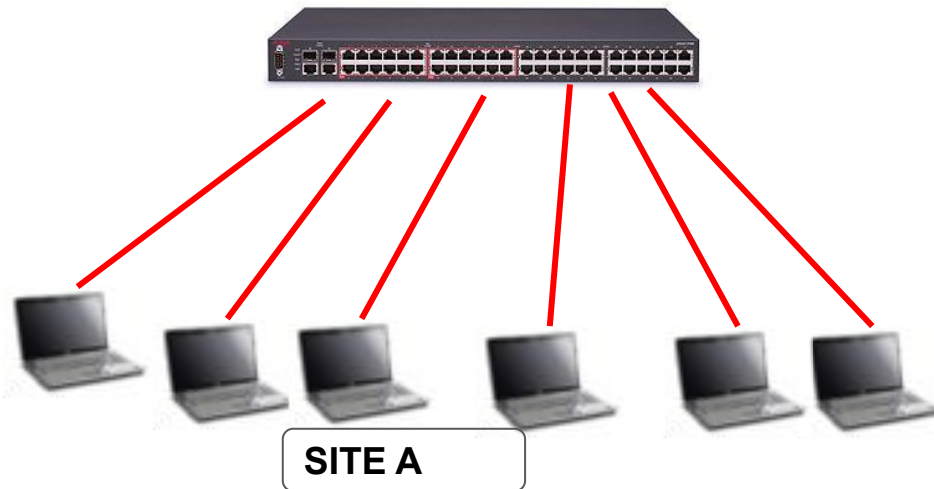
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Past experiences

- 2020 (**Congo DRC, Malaysia**): IOT integration, network automation
- 2019, **Congo (DRC)**: build a wireless ISP from ground-up
- 2018, **Malaysia**: network revamp, develop billing solution and integration, setup dynamic routing
- 2017, **Libya (north africa)**: remote wireless migration for a new Wireless ISP
- 2016, **United Kingdom**: workshop for wireless ISP, migrating a bridged to routed network
- 2015, **West Kalimantan**: supporting wireless infrastructure project

The birth of VLAN

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Typical network, no internet

- All computers just connect to one switch (concentrator)
- One network segment, **one broadcast domain**
- **Collision domain** is already splitted by switch

SITE A

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Typical network, more switches, no internet

- Network segment is extended
- Still one network segment, **single broadcast domain**

SITE A

SITE B
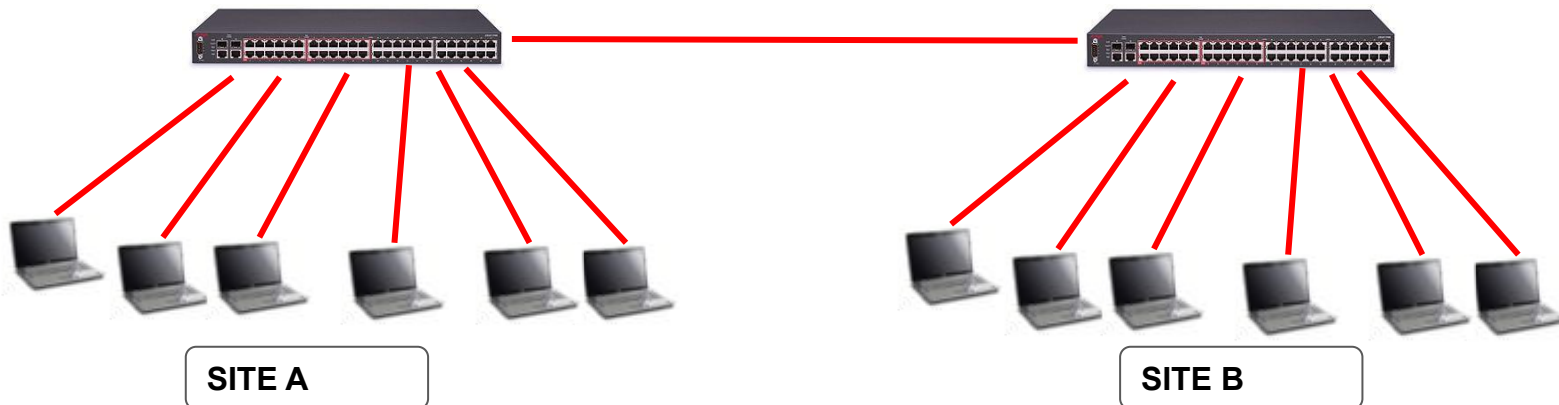
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Typical network, with internet connection

- We add a router to connect to other network (internet is a collection of networks)
-

ISP

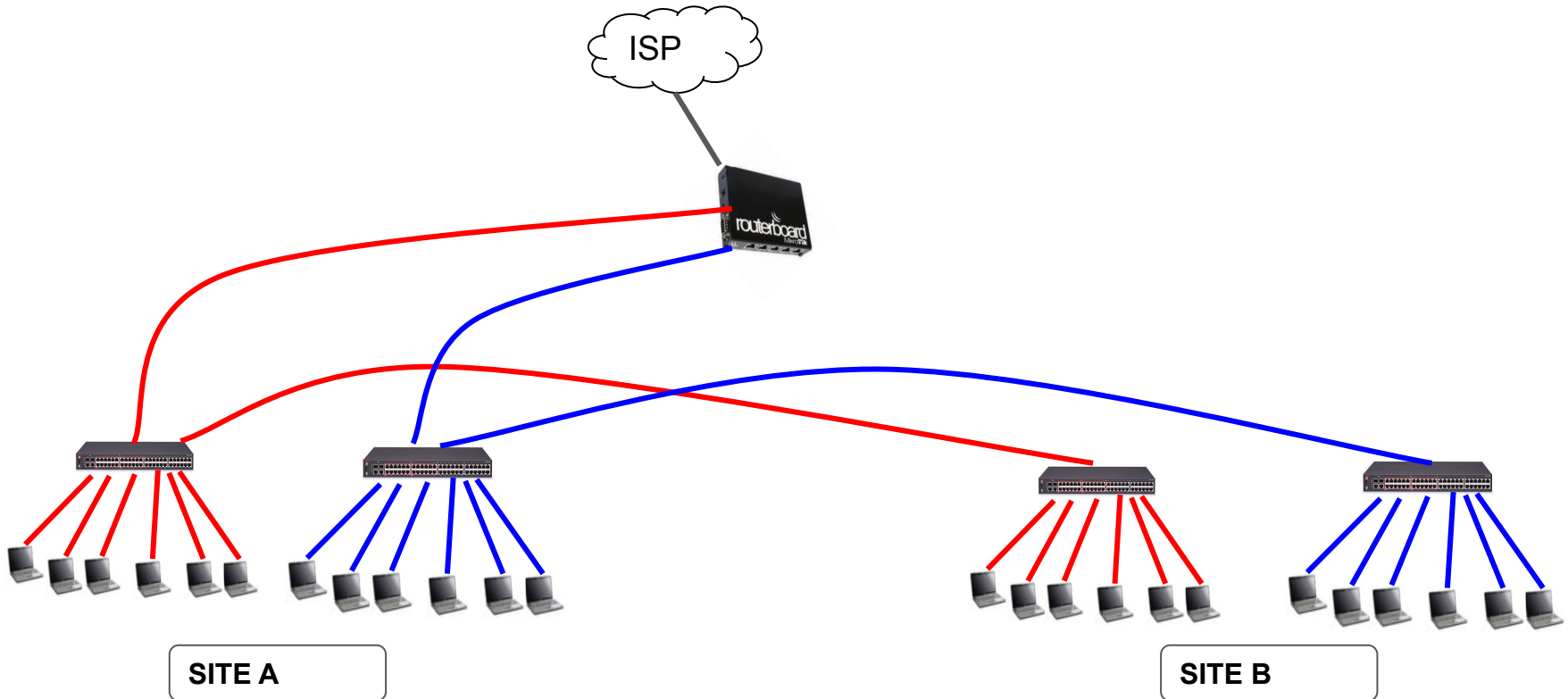routerboard

SITE A

SITE B

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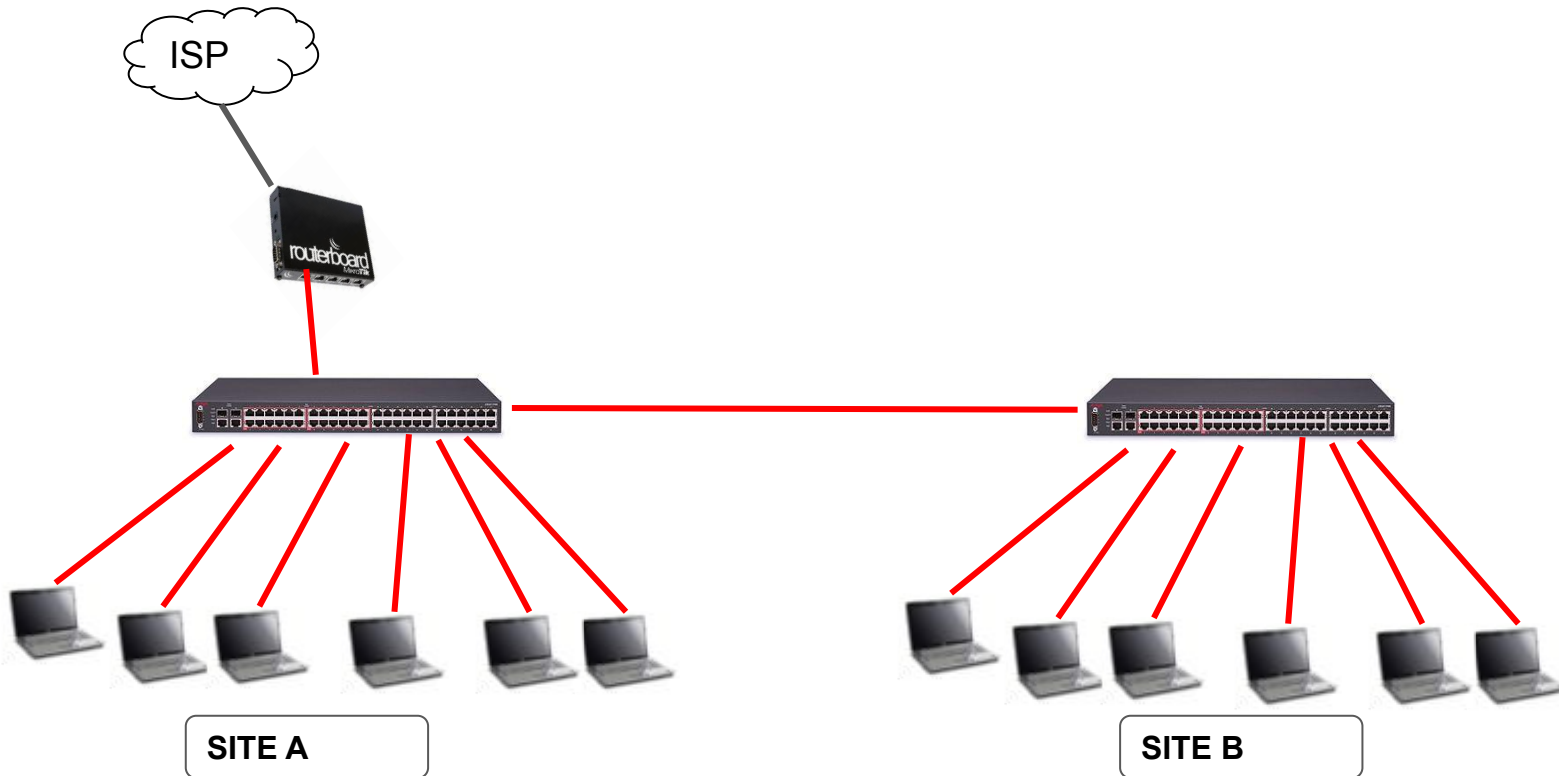
Typical network, with internet and segmentation

- A router is used to divide network based on layer 3 (network) -> different ip address segment
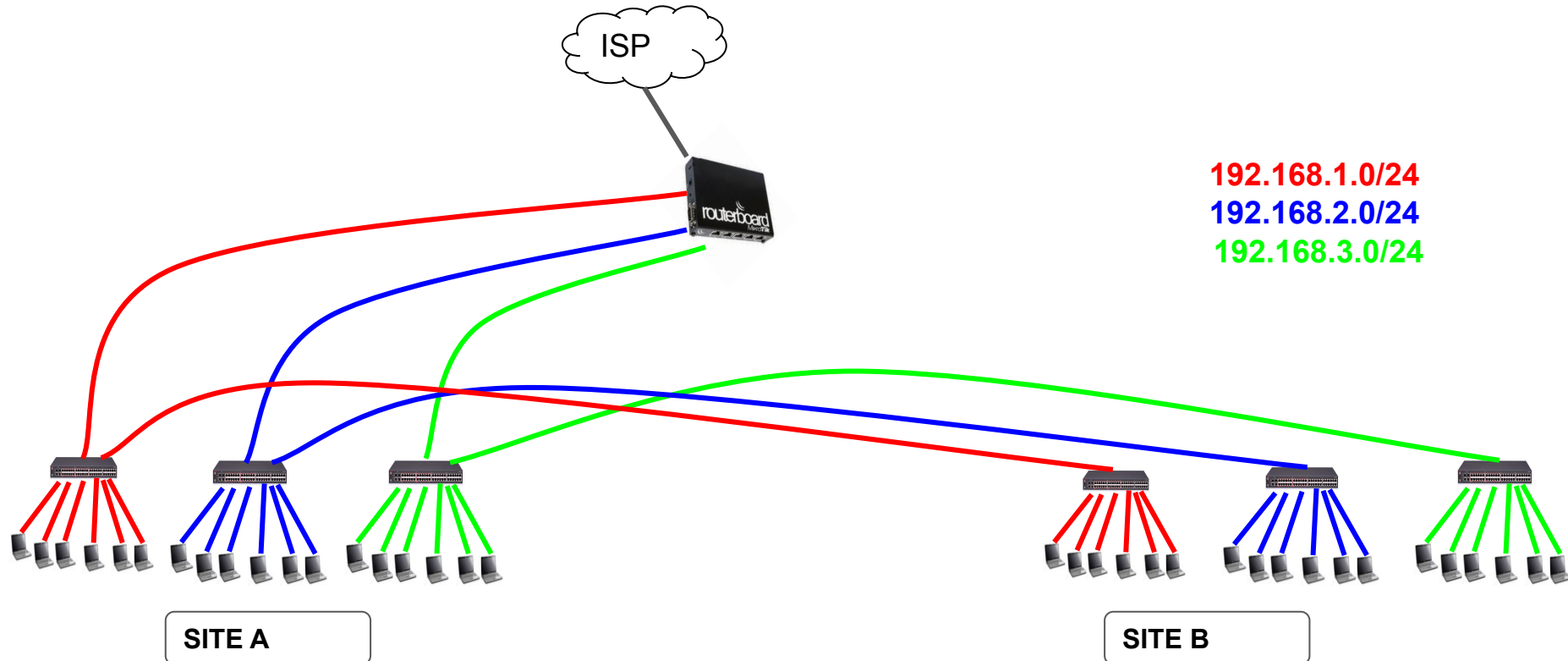- **One switch -> one segment**

SITE A

SITE B

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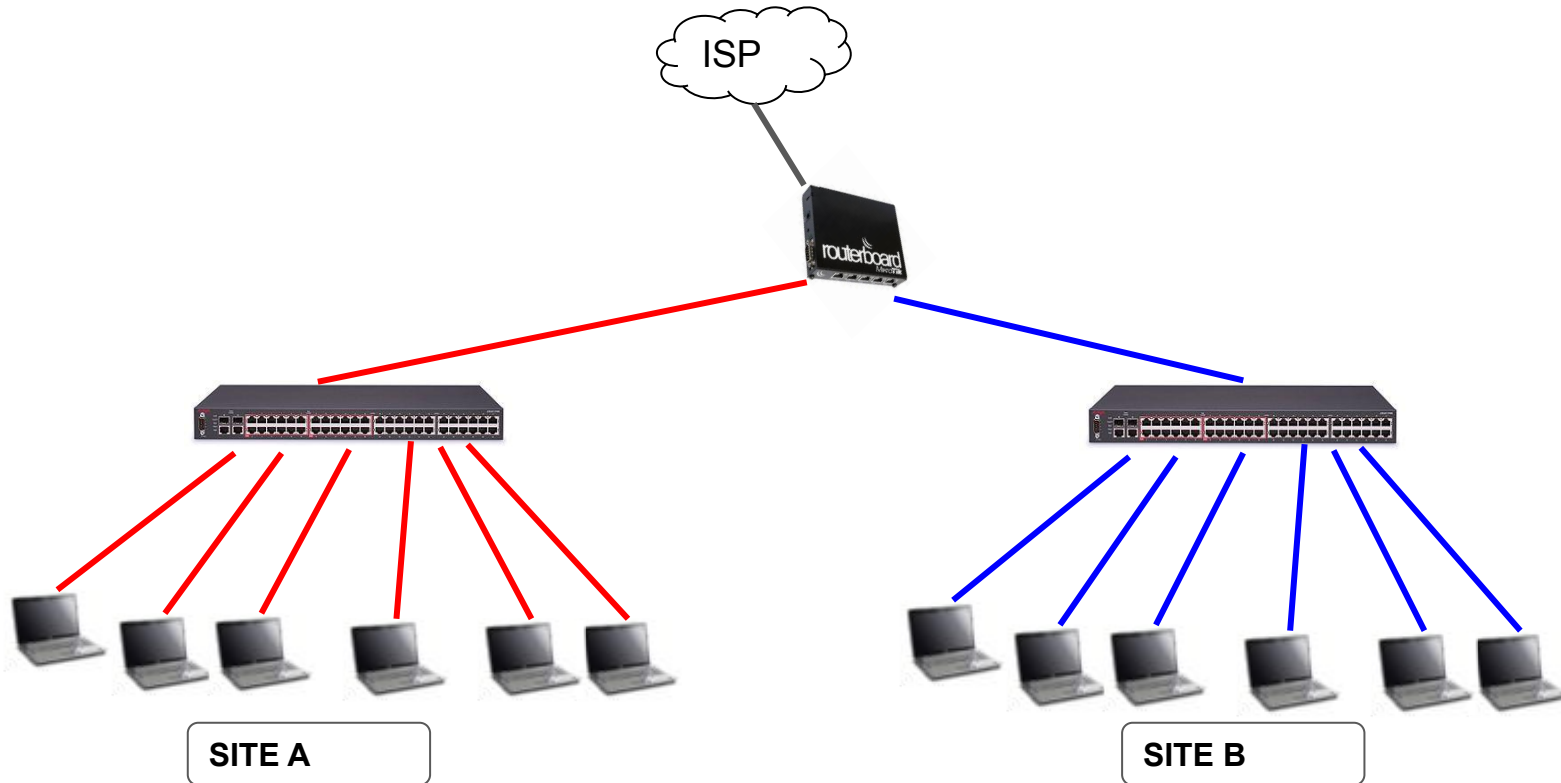
Multiple segments in one site

- **One switch -> one segment**
- **You need more switches**

SITE A

SITE B

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More segments in one site

- **One switch -> one segment**
- **You need more switches, more money**

ISP

192.168.1.0/24
192.168.2.0/24
192.168.3.0/24

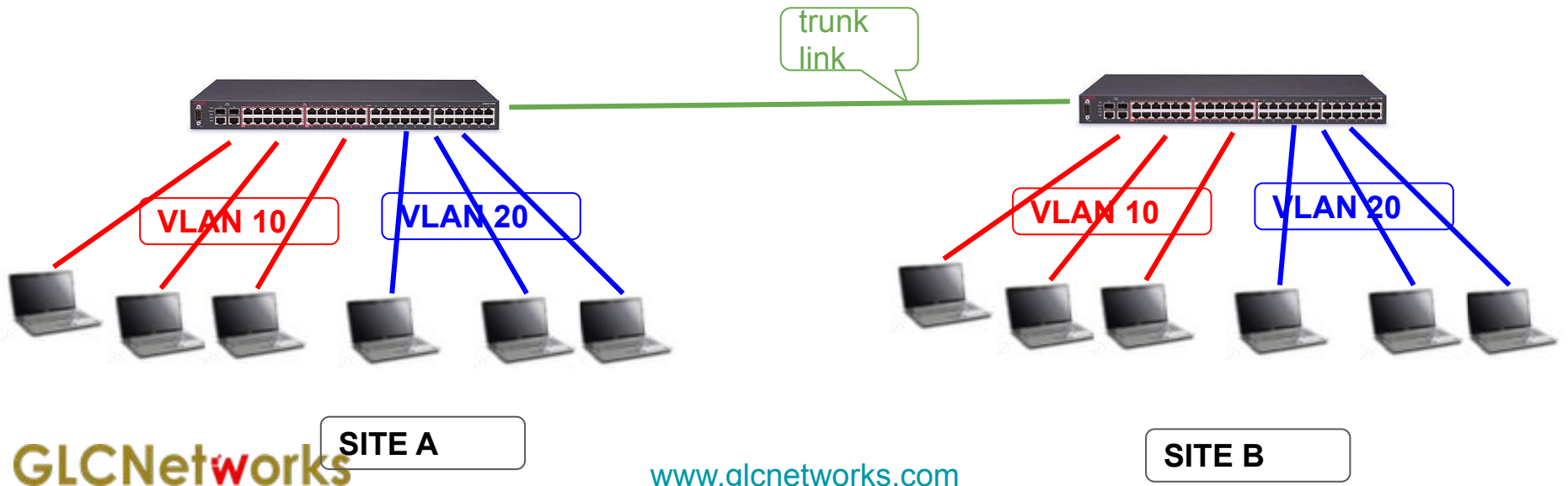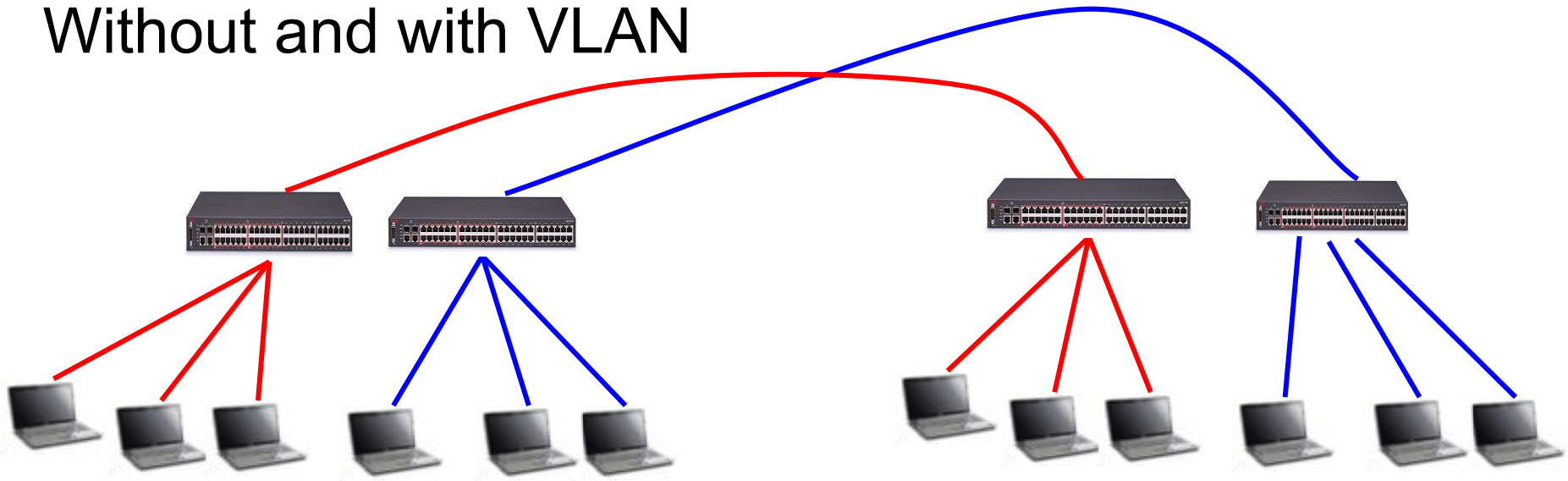SITE A

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What VLAN can do

- **One switch multiple segment,** divide the switch based on ports
- less equipment, save money, save space
- **Requires more knowledge**

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Without and with VLAN

trunk link

VLAN 10   VLAN 20

VLAN 10   VLAN 20

SITE A

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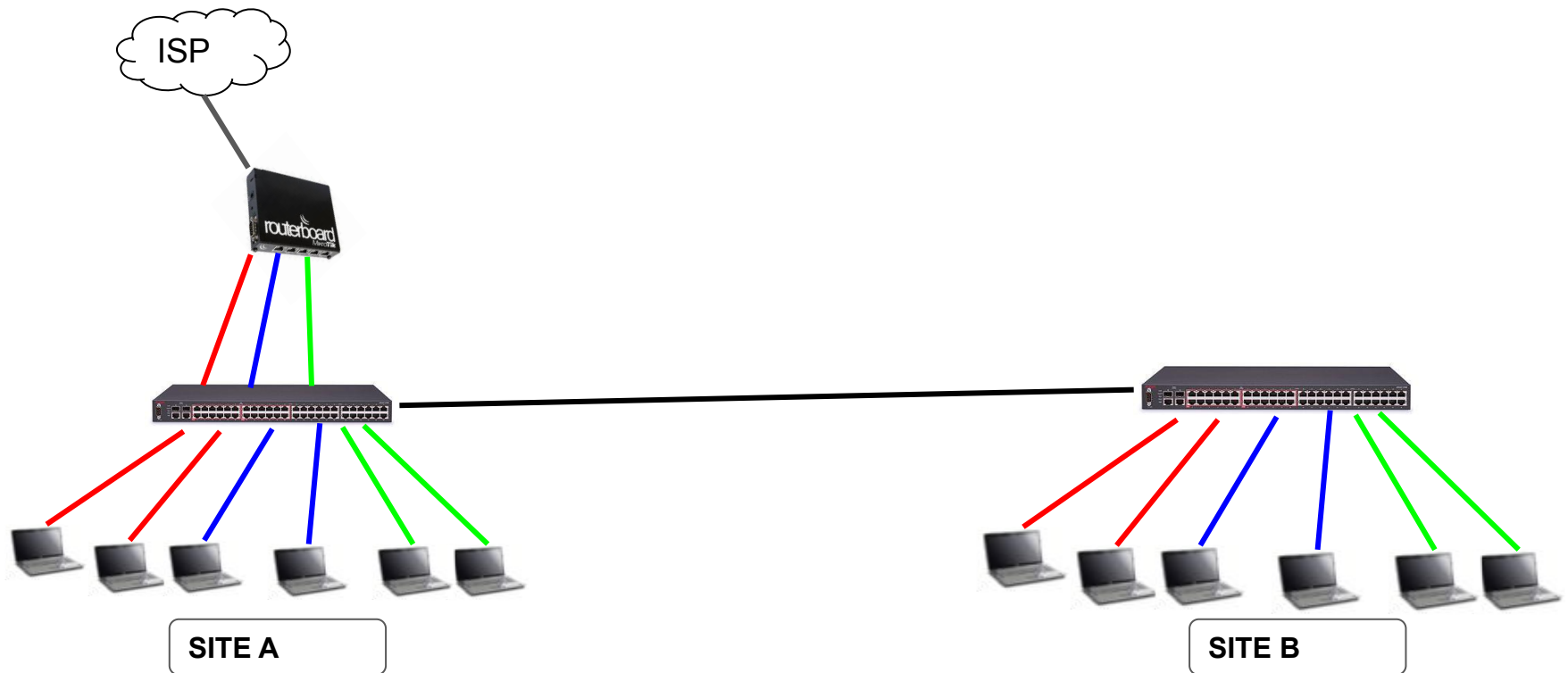
VLAN terms

- **VLAN**: a feature on layer 2 device (switch) to do virtual segmentation on physical switch
- The segmentation can be extended to other switch using "trunk" link. Borrowed from telco terms "**trunk**" (a link to connects 2 telco exchanges)
- Port types:
  - Access port -> to connect to end-devices
  - Trunk port -> to connect to other VLAN switch

trunk port

trunk port

access port

trunk line

VLAN 10

VLAN 20

VLAN 10

VLAN 20

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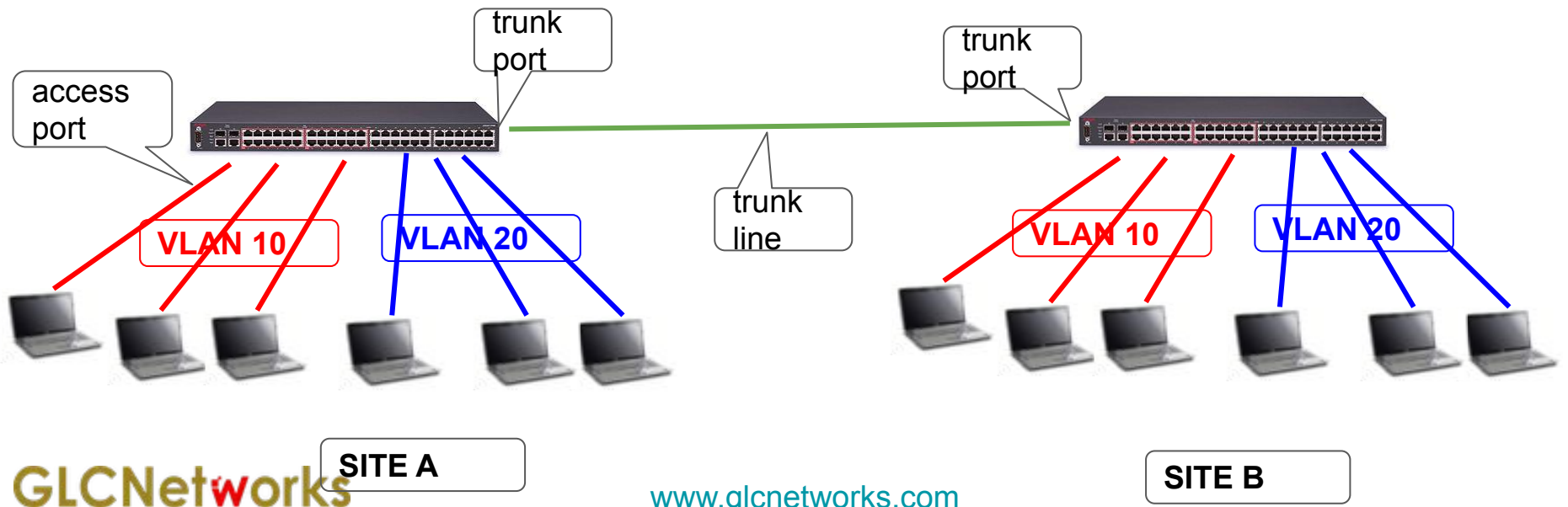
What happened on trunk ports

- The layer-2-header of outgoing frame will be modified by adding VLAN tag on the header
- This tag will be recognised at the other end

Preamble	Dest. MAC	Source MAC	EtherType	Data	CRC

Preamble	Dest. MAC	Source MAC	802.1Q	EtherType	Data	CRC

trunk port

trunk port

access port

VLAN 10   VLAN 20   VLAN 10   VLAN 20

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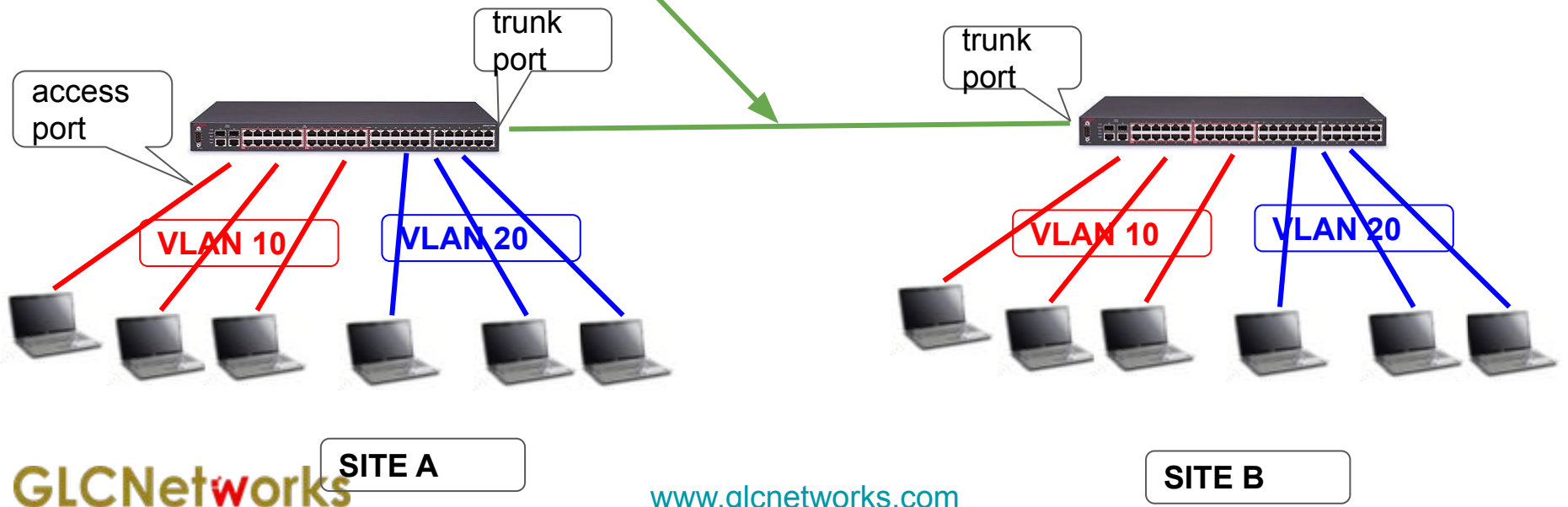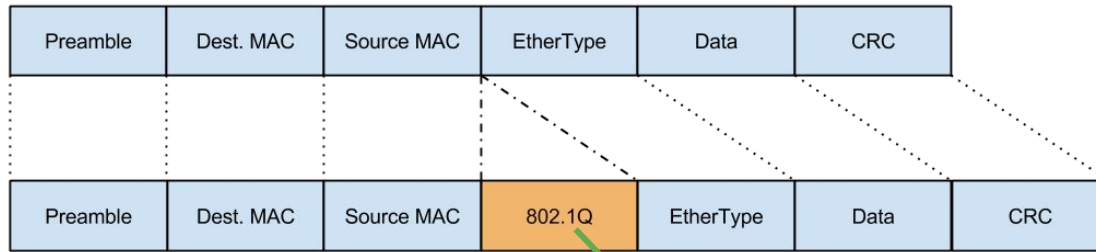
Inter-VLAN communication

- 1 VLAN = 1 network segment = 1 network ID = 1 broadcast domain
- Meaning: we need a router to route packets between VLAN
- IP address on router's interfaces will become the gateway of each VLAN

access port

access port

access port

trunk port

trunk port

VLAN 10

VLAN 20

VLAN 10

VLAN 20

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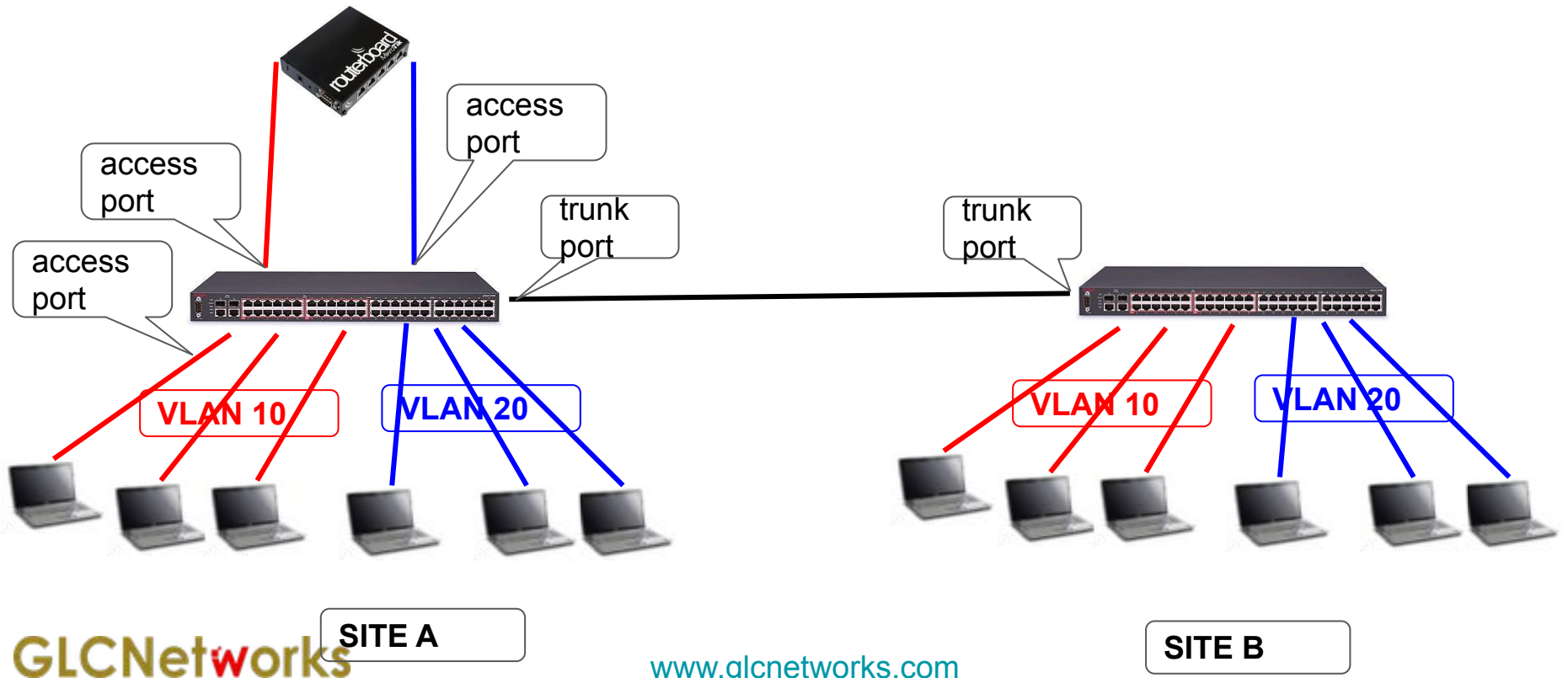
What If the router supports VLAN tag (trunk)?

- VLAN routing can be done using **only 1 port (1 cable)**
- We need to assign IP address on VLAN interface at the router

trunk port:
VLAN 10, 20

trunk port

trunk port

access port

VLAN 10

VLAN 20

VLAN 10

VLAN 20

SITE A

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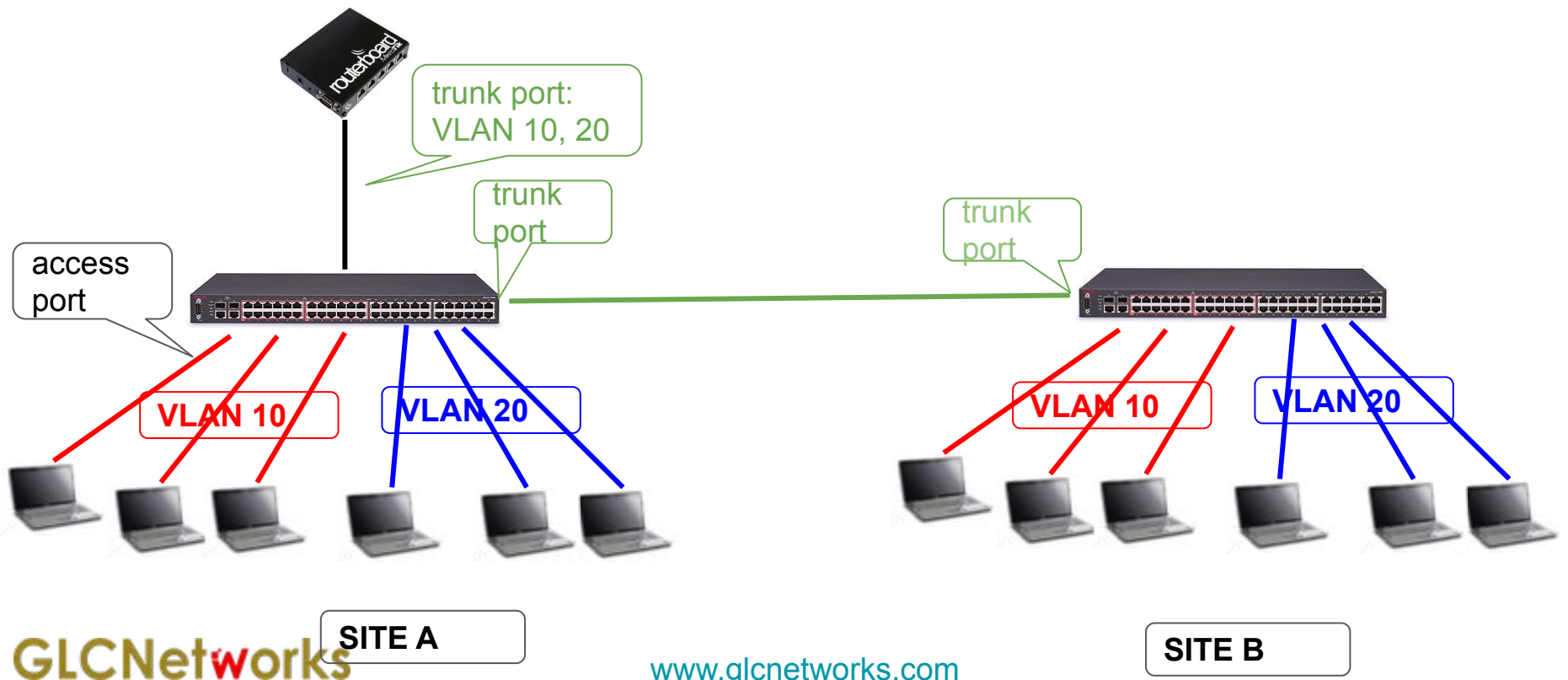
What if the switch is a layer-3 switch?

- Meaning: **routing function will be done internally on switch**.
- Meaning: **the switch is a router**.
- Layer-3 switch is **much more expensive (especially at vendor XXX)**

trunk port

trunk port

access port

VLAN 10

VLAN 20

VLAN 10

VLAN 20

SITE A

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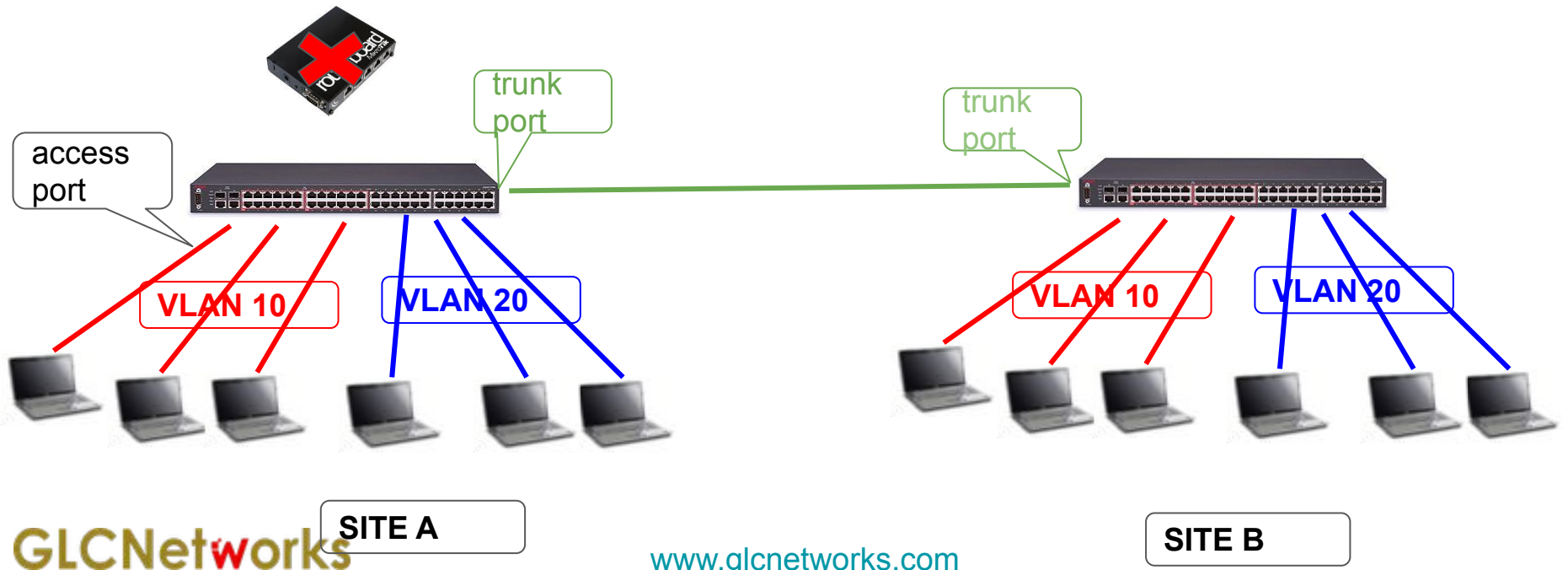
A (very funny) story (1)...

- A client using **layer-3-switches** to build their internal network, and **use Mikrotik router to do inter-VLAN routing**. **whoops…!!**
- Question: why do you buy a layer-3 switches then?
- **Congratulations to sales team… ;-) well done..!!**

trunk port

trunk port

access port

VLAN 10

VLAN 20

VLAN 10

VLAN 20

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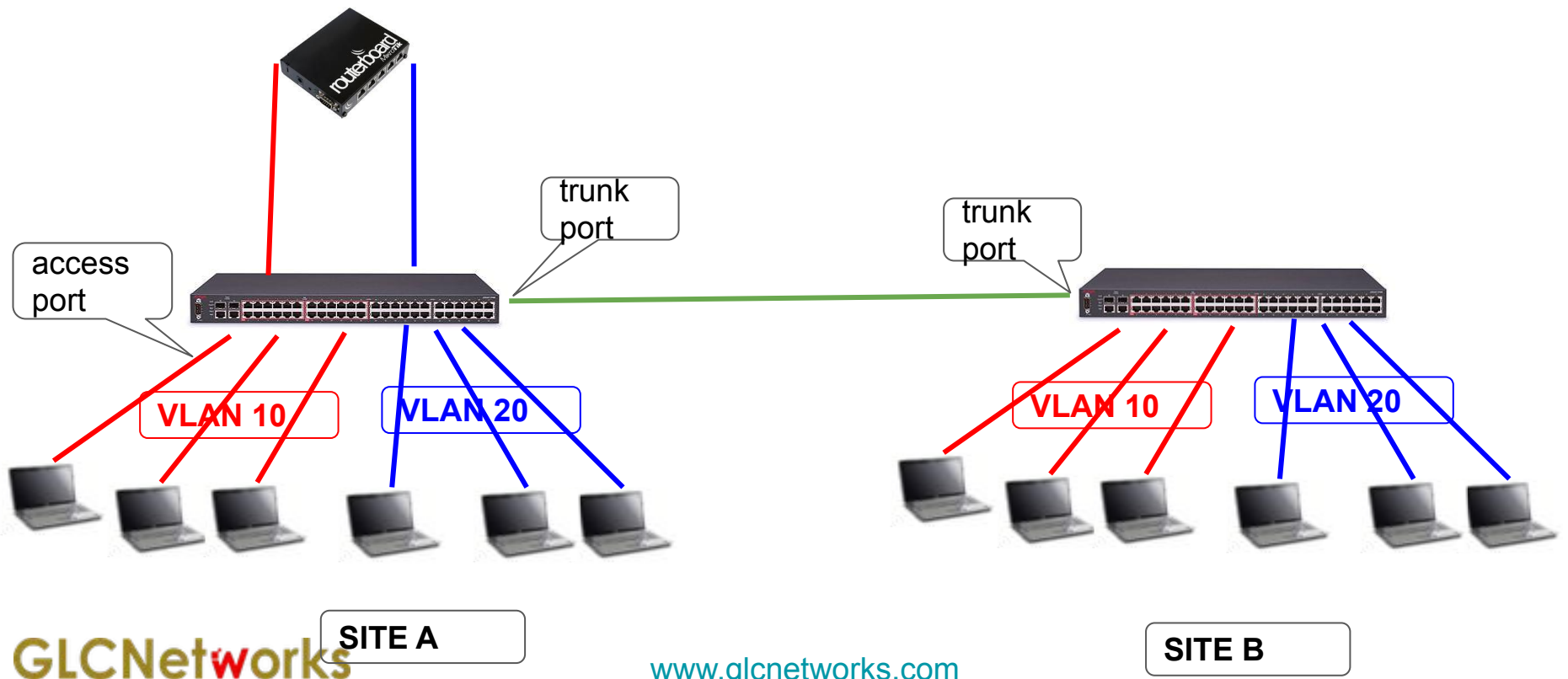
A (very funny) story (2)...

- A client has vlan running on their network
  - VLAN for wired connectivity
  - VLAN for wireless
  - VLAN for server, etc
- And then they plan to add a dedicated firewall on their network
- They cant figure out how their vlan works
- So they **remove ALL VLANs** and the it become a **FLAT network**

SITE A

SITE B

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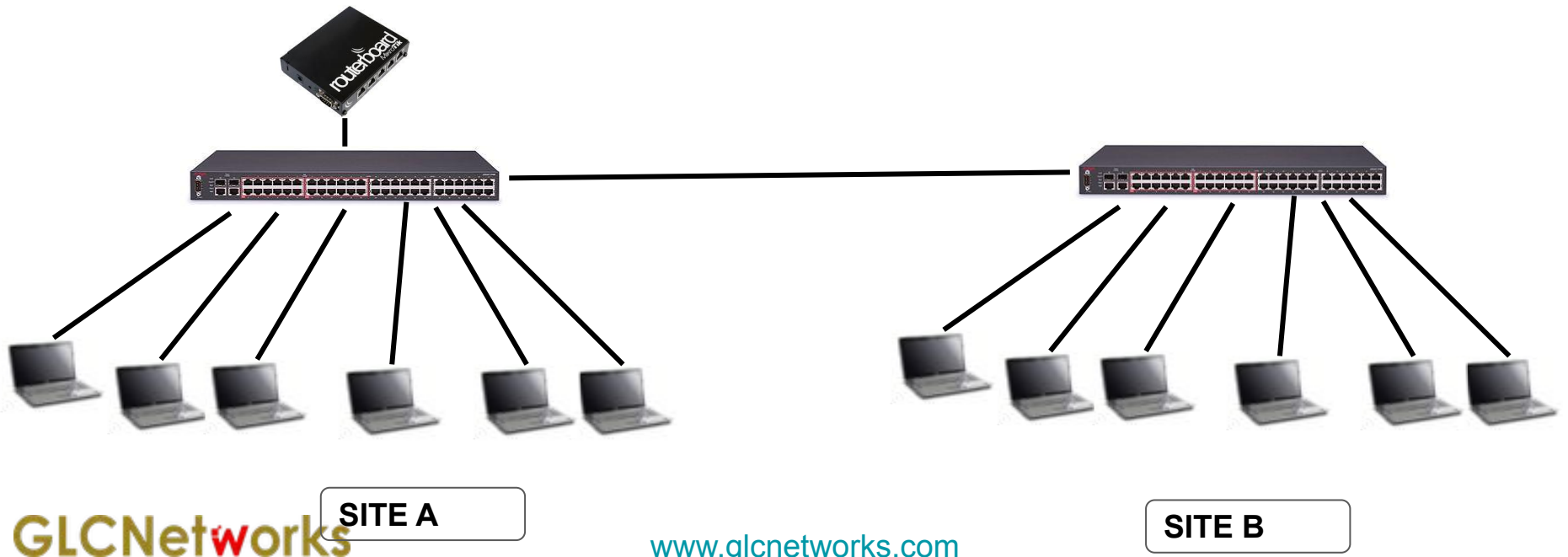
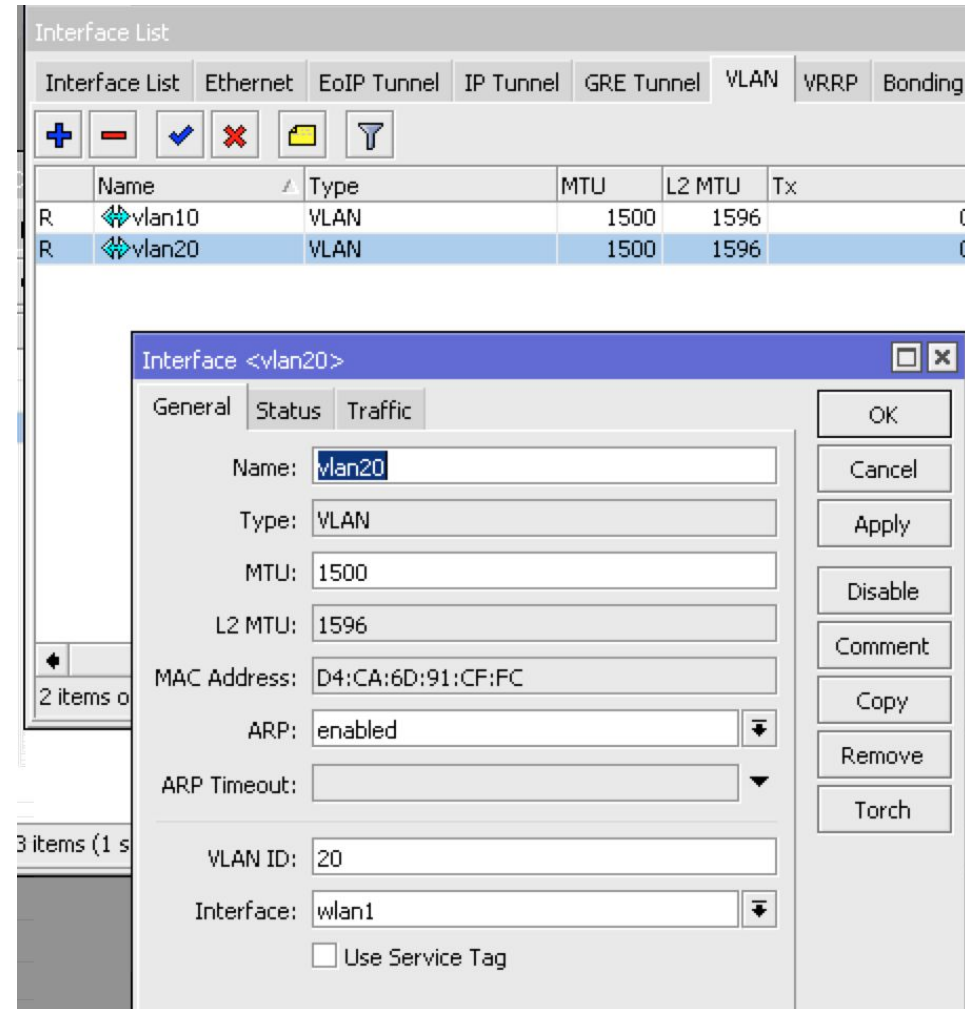# VLAN on Mikrotik

VLAN on Mikrotik router

- By default configuration, mikrotik is a router (layer 3 device)
- Mikrotik can do inter-VLAN routing
  - Without trunk
  - With trunk
- Mikrotik can be configured to become a layer 2 devices
- There is a vlan facility on interface menu for trunk port

Interface List

	Interface List	Ethernet	EoIP Tunnel	IP Tunnel	GRE Tunnel	VLAN	VRRP	Bonding

	Name	Type	MTU	L2 MTU	Tx
R	vlan10	VLAN	1500	1596	0
R	vlan20	VLAN	1500	1596	0

2 items o...

Interface <vlan20>

General | Status | Traffic

Name:	vlan20	OK
Type:	VLAN	Cancel
MTU:	1500	Apply
L2 MTU:	1596	Disable
MAC Address:	D4:CA:6D:91:CF:FC	Comment
ARP:	enabled	Copy
ARP Timeout:		Remove
VLAN ID:	20	Torch
Interface:	wlan1	
	☐ Use Service Tag	

2 items o...
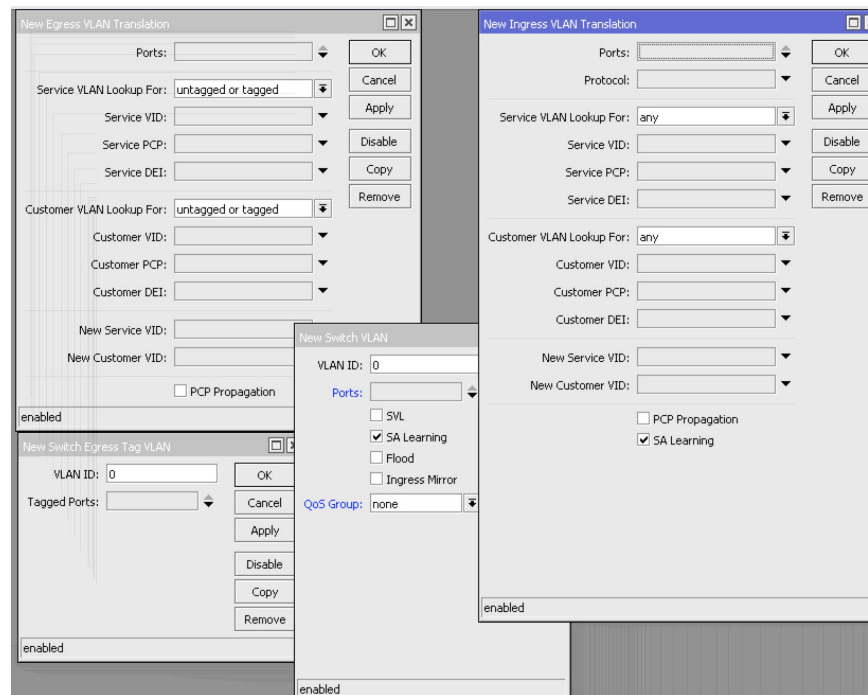
3 items (1 s...

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VLAN on Cloud Router Switch (CRS)

- Fully compatible with IEEE802.1Q and IEEE802.1ad VLAN
- 4k active VLANs
- From any to any VLAN translation and swapping
- 1:1 VLAN switching - VLAN to port mapping
- VLAN filtering
- Flexible VLAN assignment:
  - Port based VLAN
  - Protocol based VLAN
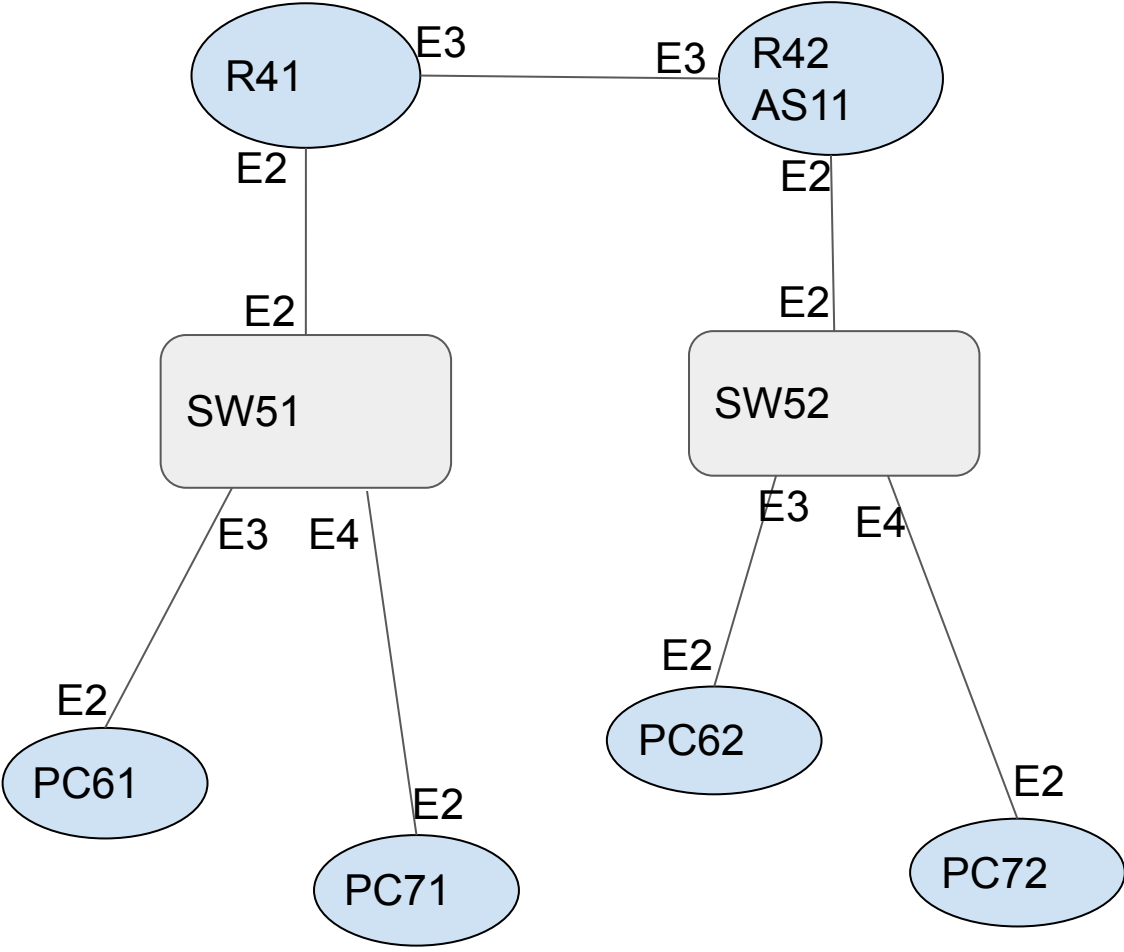 - MAC based VLAN

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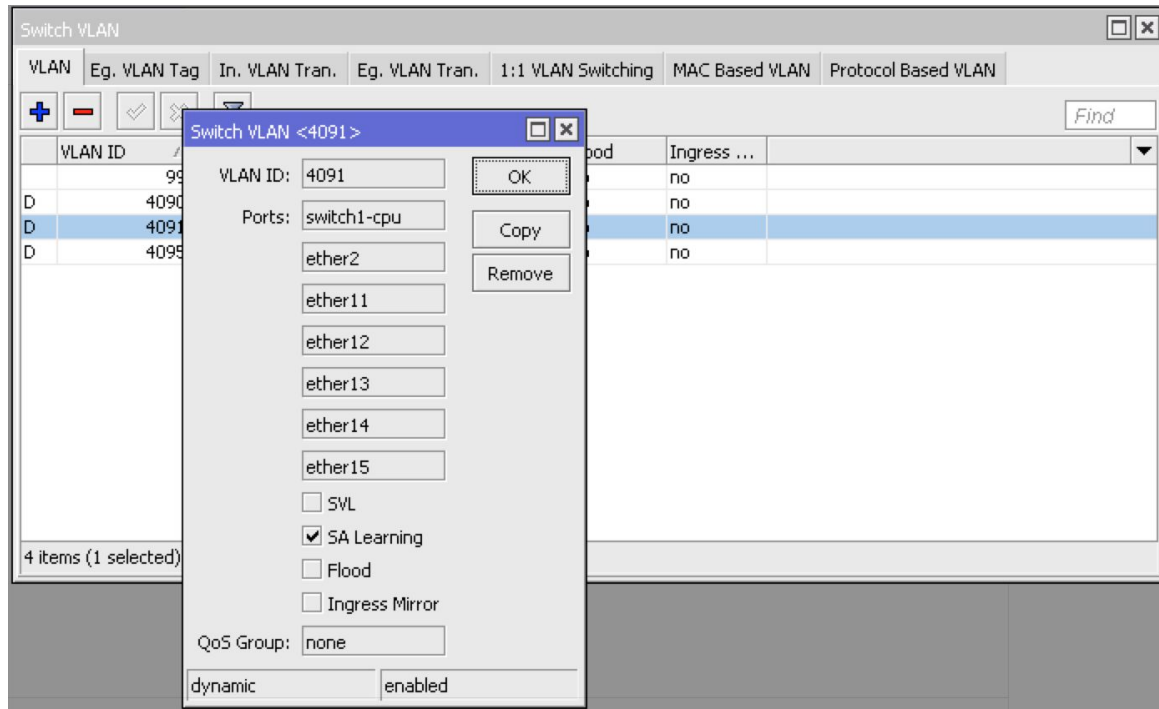
VLAN on CRS

- CRS has more layer2 features which is bound to hardware
- VLAN configuration on CRS1xx / CRS2xx is slightly different than CRS 3XX
- VLAN command on CRS is slightly different than routeros, however the concept is same

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Demo

TOPOLOGY
LAB: VLAN

R41 — E3 ——— E3 — R42 AS11

E2 — E2 (R41 to SW51)

E2 (R42 to SW52)

SW51

SW52

E3   E4 (SW51)

E3   E4 (SW52)

E2 — PC61

E2 — PC71

E2 — PC62

E2 — PC72

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TOPOLOGY
LAB: VLAN

R41

E3

E2

SW51   br1 (e2, e3)   br2 (vlan10-e2, e4)   br3 (vlan20-e2, vlan20-e5)

E3   E4   E5

E2

PC61

E2
PC71

E2
PC81

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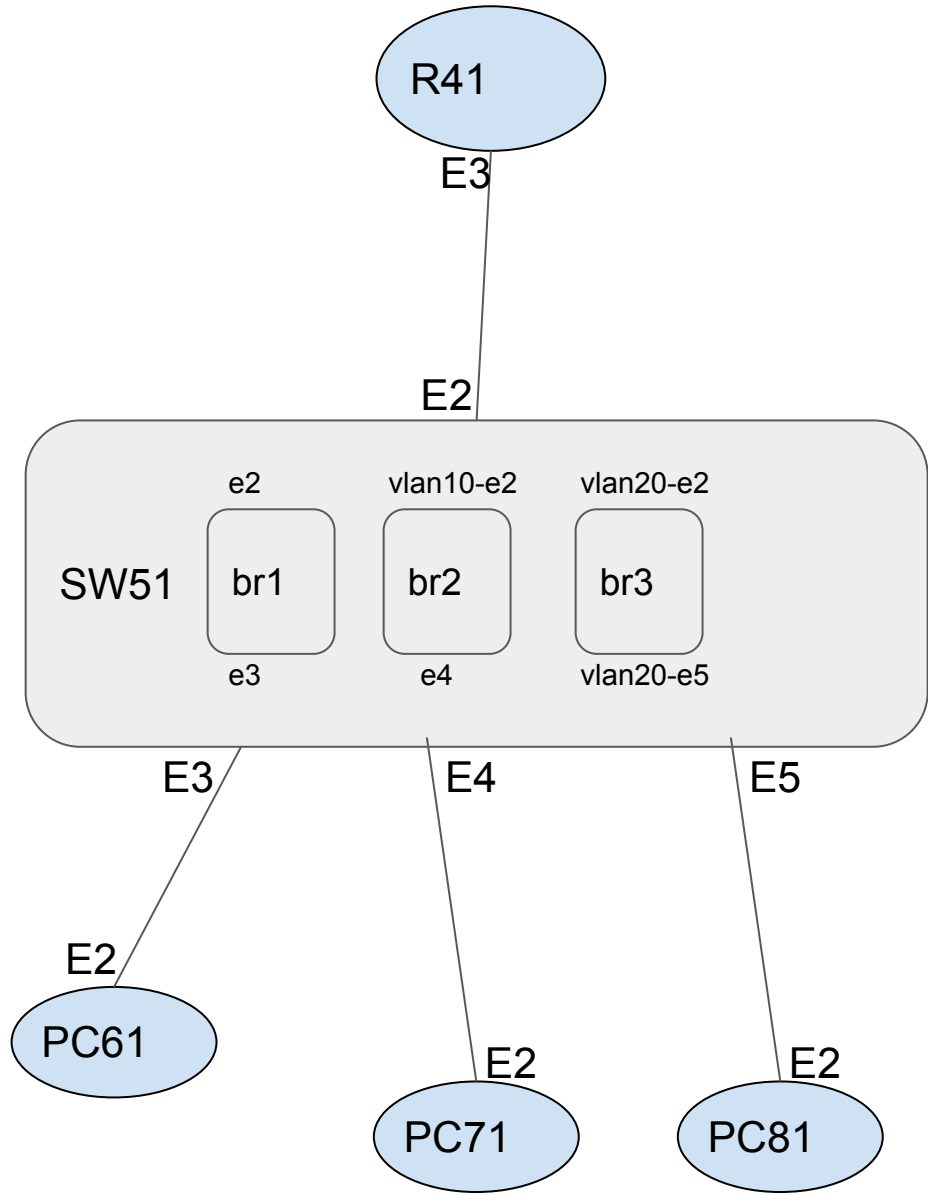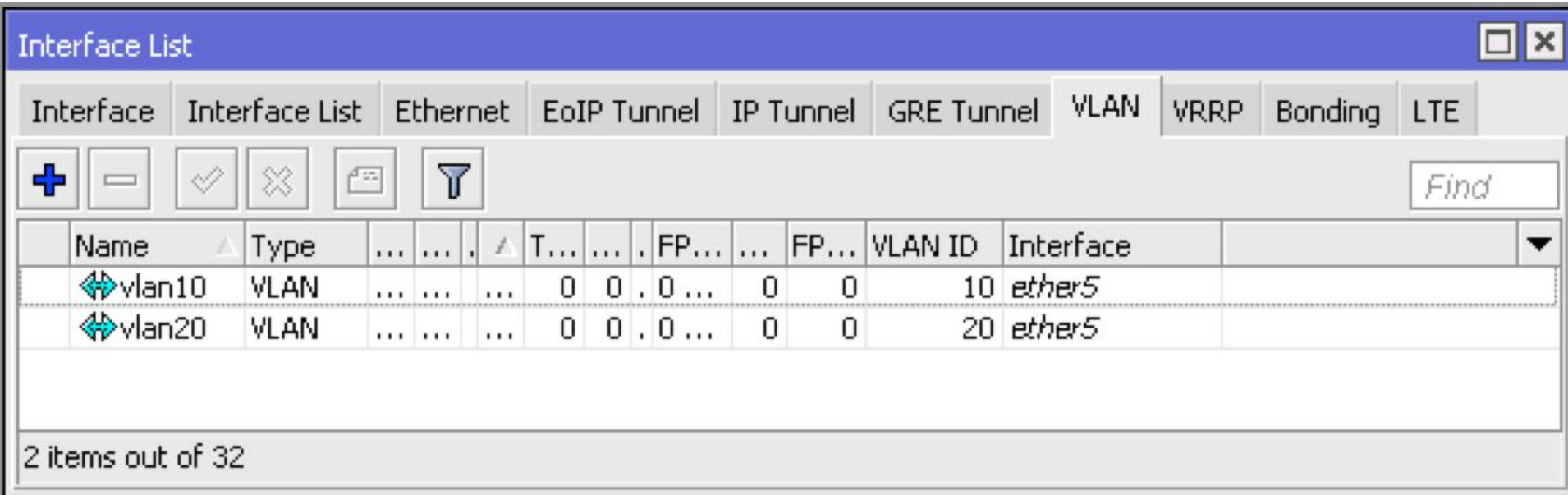
VLAN on RouterOS

Ether5 is used to route vlan 10 and 20:

- /interface vlan add name=vlan10-e2 vlan-id=10 interface=ether2
- /interface vlan add name=vlan20-e2 vlan-id=20 interface=ether2

Interface List										□ ✕

Interface | Interface List | Ethernet | EoIP Tunnel | IP Tunnel | GRE Tunnel | VLAN | VRRP | Bonding | LTE

| ✚ | ⊟ | ✓ | ✕ | ⌷ | ▽ | | | | | | | Find |

Name	Type	...	...	.	△	T...	...	.	FP...	...	FP...	VLAN ID	Interface		▼
⬌ vlan10	VLAN	...	...		...	0	0	.	0 ...	0	0	10	*ether5*		
⬌ vlan20	VLAN	...	...		...	0	0	.	0 ...	0	0	20	*ether5*		

2 items out of 32

QA

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Some info

- Hope you are more curious now
- These materials are part of Mikrotik Certified course
- If you are interested, you can sign up to our website

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End of slides

- Thank you for your attention
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